Jan.-Feb., 1958

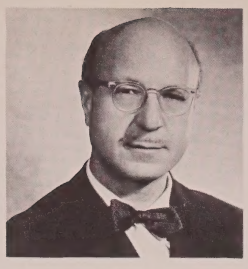
MOTOROLA

newsgram

Published by Motorola Inc., Communications and Industrial Electronics Division

In this issue . . .

Her duties require considerable traveling around St. Anthony de Padua Hospital, yet Sister M. Josepha can still be reached quickly, quietly with her Motorola Radio Pager . . . . See pages 6-7.



EQUIPMENT RELIABILITY

If you have followed the many military magazine articles dealing with military equipment design, development, and production, you will remember the persistent screaming about the unreliability of military electronics equipment. First, the development of supersonic planes and, second, the projected use of missiles with speeds of 1200 miles an hour and more, constantly taxed the frontiers of the electronics art to develop equipment capable of controlling and making effective the missions of such planes and missiles. Finally, the need for providing electronically guided planes and missiles equipped to counter the enemy weapons of destruction adds to the demand for extended performance. This constant straining toward precision control and microsecond timing to meet the advances of the weapon systems art has mushroomed the complexity of electronic equipment to the point where the attempts to design reliable equipment are vitiated by the pressures to achieve super performance. Reliability is a function of conservative design. It is impossible to build reliable equipment without using factors of safety for each component, circuit, and structure of the equipment pattern. In military electronic equipment, our race to achieve the ultimate in performance has out-stripped our ability to discipline the designs within limits necessary to achieve adequate reliability. Our complex military electronics systems are crowded with design imbalances characterized by mixtures of conservative circuitry and immature products of applied research and unresolved cut-and-try experimentation. Reliable military electronics equipment cannot be developed and produced until the military and electronic industry executives direct the design engineers to build-in the safety factors which are essential to reliability of performance.

In the mobile communications industry, we have not been pressed by the necessity for meeting fantastic new standards of time, temperature, and complexity. In industry, we can design reliable equipment. The degree of reliability is determined by the integrity of purpose and by the accumulated experience phased into the design problem, with some modification dictated by the price the customer is willing to pay. I take a great deal of personal pride in the fact that Motorola's phenomenal success in the mobile communications field springs from the basic concept of exceptional equipment design integrity. Design integrity means more than an academic design of equipment which will work; it means design for reliability; it means design for maximum reliability at a reasonable and practical cost. Design for reliability also means a balanced design, for it is possible to over-design some parts while failing to provide adequate tolerances and factors of safety for other parts. An imbalance can produce *costly* equipment which is *still unreliable*. Our aim has been to produce a balance design with costs added where the additional expense will pay off in superior performance. We have never attempted to build the lowest cost equipment, but we are genuinely dedicated to our objective to build the best equipment. You understand, of course, that the building of the best equipment requires a continuous effort, and the accumulation of information which aids in the process comes from many sources. Chief among the sources of information is the great body of users of Motorola equipment. You have helped us to improve our equipment steadily, and you can continue to contribute to our efforts to supply you with the best mobile communications equipment in the world. You help by keeping us informed about the performance of the equipment. We depend upon field information to keep our research and development activities moving. Boiled down, our pattern of operation works something like this:

1. We are specialists. Our Communications and Industrial Electronics Division engineers are widely experienced in the mobile communications field and their experiences are constantly enhanced by laboratory development, design work, and field and environmental testing. Specialization, which means the utilization of a vast pool of accumulated and constantly growing Motorola confidential information about mobile communications system and equipment design, is the first essential ingredient of design reliability and design integrity.

2. We carry on constant field testing of new designs and equipment in production to check and re-check the performance, reliability, and designed adequacy. The responsibility for the equipment performance remains in the hands of the engineer all the way from the design concept to customers' use of the equipment. Our engineers evaluate their personal achievement by the level of successful performance of the equipment they deliver to the customer. An aggressive, searching and continuous program of quality assurance is an essential part of Motorola's approach to design integrity.

3. The ultimate judge and jury of equipment performance is the customer. Motorola has always recognized this fact and we devote a great amount of attention to the feed-back system of reports from the field. The Motorola "quickie-card" reporting system is used by every serviceman, by every field engineer, and by interested customers. You can help us to insure constant improvement in the Motorola design by reporting promptly, every failure and every performance limitation observed in the use of Motorola equipment where there seems to be the slightest possibility that equipment design is involved. Every report from the field receives sharp attention by a group of quality assurance engineers. The report is analyzed to determine whether it is a random component failure or whether the fault is related to workmanship component specification, or engineering design. This flow of information from the field enables us to monitor the design and reliability of our products, so that our customers are assured of an adequately balanced design for truly exceptional performance.

Remember that your letters of critical appraisal of our equipment performance are always welcome.

Dan Noble

MOTOROLA
newsgra

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Technical Information Center

FEATURES

Chicago Fire Department Has Its Own CIC 4
Pocket Radio Pager Delivers Direct Voice Messages 6
How To Get Full Value From Your Radio System 8
Radio Activity On The Monon .. 10
Two-Way Radio Expedites Petroleum Distribution 12
Stahlman Increases Strip Mine Tonnage with 2-Way Radio .. 14
Powerful Medicine For Rural Practicioners 1
Quality Service...Faster...With 2-Way Radio .....
Microwave Solves Telephone Right-Of-Way Problems ....

TECH NOTES

Motorola Microwave Antenna Systems 20–21
Service Hints and Shop Notes .. 22–23
FCC Bulletins 24
New Products 25
Power Transistor and Power Amplifiers 26–27
Optimizing System Performance. 28–29

NEWS

Late News 3–30
Sales Directory 31

Please address all inquiries concerning sales, service or distribution to:

MOTOROLA COMMUNICATIONS and ELECTRONICS, INC.

4501 W. Augusta Blvd.,
Chicago 51, Illinois

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mc. Inc

Name 3 Distributors For Transistor Line

Cramer Electronics, Inc., Boston; Milgray Electronics, New York; Allied Radio, Inc. and The Newark Electric Company, both of Chicago; have been appointed distributors for Motorola Semiconductor devices.

They will market the regular line of Motorola semiconductors, as well as several transistors available only from jobbers and distributors. The new distributor arrangement will service the industrial and amateur markets. Transistors used in Motorola's communications equipment will continue to be handled by Motorola's Parts and Service Dept. » » »

The Atc
Fe Railroad ha
tion of a 60-mile Mc
wave system from To
Argentine, Kansas. The new sy
tem incorporates 6 channels of Motorola Multiplex—2 channels for teletype and telegraph, and 4 channels for two-way voice, R. Floyd McCall, Vice President and Manager of Radio Product Sales for Motorola Communications and Electronics, Inc., announced. Two straight-through repeaters will be used, each having its own 100-foot tower. The system will follow the general route of the Santa Fe main line. » » »

'IRE DEPARTME

Network, Ultra-Modern Apparatus

torola equipment used between
n office and Company No. 89 on
cago's far north side.

was not until a week later
firemen were able to relax
efforts with certainty that
grain fire had at last burned
out.

This fire, one of the largest in
icago in recent years is an ex-
mple of what the fire department
in the nation's second largest city
must be prepared to combat. In
many respects, every city and
town, large and small, face the
same problem—to be prepared to
fight major conflagrations with
the apparatus and manpower
available to handle the daily fire
problems.

At this fire, calling out the ap-
paratus was only the first step.
After that there was the need for
maintaining communications be-
tween the main office and officials
directing fire fighting activities.

Chicago's answer to this need
is a predominantly Motorola two-
way radio system providing com-
munications anywhere within the
220 square mile city area. Main
control center for this radio sys-
tem is located on the 5th floor of
the City Hall.

When the extra alarm sounds,
men at the center swing into ac-
tion. Radio contact is made with
the first radio equipped vehicle
to arrive at the fire, then a com-
mand car is designated for this
fire. From this time on, all mes-

ıg
was
oldest

only $5,000,-
grain and an eleva-
ose replacement cost was
mated to be about the same,
but an adjacent, even larger grain
elevator, and numerous freight
cars, bridges, buildings and
barges in the vicinity, whose ex-
istence was periled by a shower
of sparks that covered a three-
block area.

At 9:53 P.M. a 4-11 alarm
sounded; the 2-11 and 3-11 alarms
were by-passed. Then followed a
5-11 alarm and eight special
alarms. Firemen worked day and
night to restrict the stubborn
blaze and limit damage. Although
a barge and a number of freight
cars adjacent to a burning grain
elevator were destroyed, the
larger grain elevator, and a barge,
a bridge and a number of other
structures were saved.

With extensive waterways winding through Chicago's Loop, fireboats are an important part of the city's fire-fighting equipment. Motorola radio provides contact with land forces.

ENT HAS ITS OWN CIC

Give the "Windy City" Unexcelled Fire Protection

sages with the main office alarm headquarters are cleared through the command unit.

Back at main (the main office), a fireman at a dispatch panel operates banks of keys to show movement of fire fighting apparatus on a 12 foot high, light-dotted city map. This map facilitates the intricate handling of fire apparatus which becomes necessary in case of extra alarm fires.

The map shows major streets, breaks the city up into square mile areas and visually portrays by means of lamps the location of all engine companies and hook and ladder companies.

Any areas that might be unprotected because their companies have gone to the fire, or are filling in for other companies, are revealed instantly. Steps are taken immediately to fill in such areas. In case other fire calls come in, radio communications make it possible to direct a fill in company to the new fire without a second's hesitation.

At the fire, officials, like officers on a battle field, determine what reserves must be brought up, and how the equipment and firemen shall be deployed. Herein lies the second communications problem—maintaining communications in the 3 square block area. Some hoses have to be strung 5 blocks to reach hydrants, a myriad of train tracks hinders movements of trucks, a heavy downpour adds to the numerous streams of water, producing mud and water a foot deep in spots. Visual signals are obscured by smoke or intervening structures; audible calls are over-shadowed by the sound of pumpers, sirens and the general din that accompanies fire.

The answer to these problems lies in wireless communications provided by portable radiophones. This strategy is one that the Chicago Fire Department has developed to a very high degree and has successfully been used at many major fires.

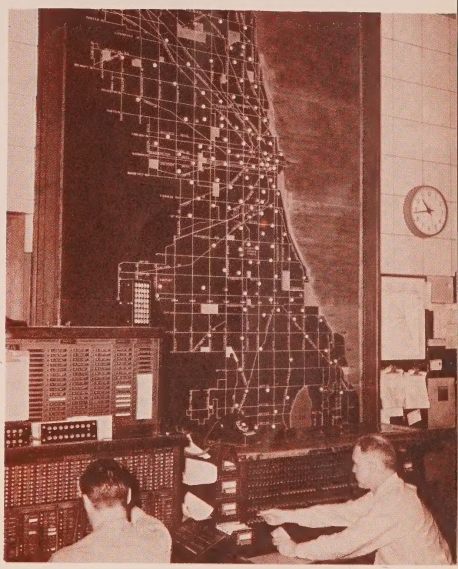
The Chicago Fire Department has a two-way FM radiotelephone system comprising three Motorola 250-watt base station transmitters remotely controlled from two locations. Each of the three base stations is capable of providing city-wide coverage. One is located approximately five miles southwest of the Loop, another is located approximately eight miles south of the Loop, and the third is about seven miles northwest of the Loop.

Two of the towers servicing these base station transmitters are 168 feet high. The one southwest of the Loop is 218 feet high. All three towers are being used by both the Police and Fire Departments in their regular operations.

Extensive tests made to determine possible radio coverage obtainable with these base station facilities revealed that communications could be maintained with a radio-equipped mobile Civil Defense unit as far north as Milwaukee, about 90 miles away. In general, good coverage is provided for an area in excess of 3,000 square miles.

Recognizing the advantages of having radio-equipped fire apparatus, the City of Chicago has installed 191 30-watt Motorola mobile units in various vehicles. It is a rule that there be a radio unit in at least one piece of fire apparatus in each fire station. There are two-way radio units in the cars of Department Officials, including the Chief Fire Marshal, Deputy Chief Fire Marshals, Division Fire Marshals, and Chiefs of Battalions.

Also, thirteen squad cars, sixteen ambulances, fire boats, and many of the engine companies and hook and ladder companies are similarly equipped. In addition, each division and battalion chief's car carries two Motorola "Handie-Talkie" portable radiophones for communications at a fire. » » »

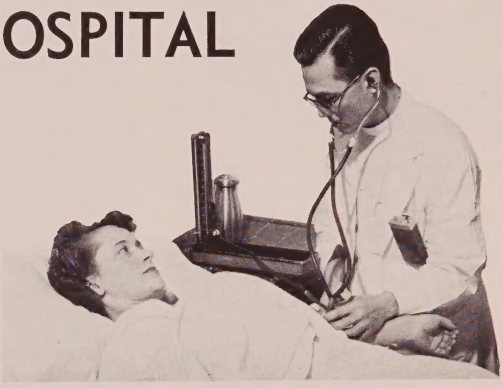


Dispatch map used for extra-alarm fires shows location of all fire companies. During extra-alarm fires, lights indicate understaffed sections.

Four Motorola remote control consolettes in the main fire office operate the three main base stations and an auxiliary station on the north side.

COMPACT RADIO PAGER DELIVERS QUIET VOICE MESSAGES AT ST. ANTHONY'S HOSPITAL

Continuous and uninterrupted contact with staff members throughout the entire 24-hour day is mandatory for successful hospital operation. Yet, there are various factors peculiar to all hospitals which present certain problems in establishing such optimum communications systems.



Dr. Paguia of the St. Anthony staff attends a patient, secure in the knowledge messages for him will be promptly delivered via radio.

The problem of quiet, of course, is of paramount importance. On afternoon and night shifts, patients' rest and sleep must not be disturbed. Use of a public address system during these periods is necessarily limited. Even without these restrictions, speakers cannot always be heard in patients' rooms, between buildings, in the chapel or on hospital grounds.

Sister M. Josepha, assistant administrator at St. Anthony and chief laboratory technician, wears a Motorola "Handie-Talkie" radio pocket pager while going about her duties. Messages reach her instantly, even in the confines of the laboratory where she is shown.

Similar disadvantages hold true in the case of buzzers or a system of lights. In any case, it would require a personal visit or a telephone call by the person being paged before a message could be completed. This takes time, which is of particular importance to hospitals, since the greater percentage of work performed therein is of an emergency nature.

Many of the problems of intra-hospital communications can now readily be solved through use of the Motorola radio paging system. An example of the successful use of this equipment is the paging network installed at St. Anthony de Padua hospital in Chicago.

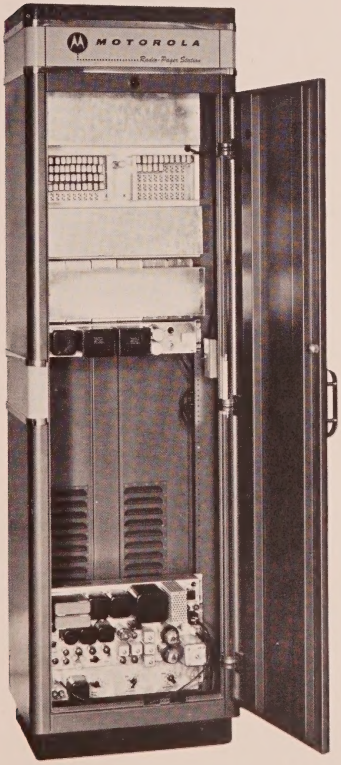
The paging system now has 30 individual units in service, and more can be added when required. Each of these Motorola "Handie-Talkie" paging receivers is small —so compact it is only slightly larger than a "king size" package

of cigarettes. Clips are provided for securing the receiver to the user's pocket or belt.

These units receive messages from the switchboard operator, who uses a dialing system to signal a specific unit. After a short pause, the operator gives the message. The wearer is alerted to his call by a soft "buzz" produced by the pager. On hearing this signal, he pushes a button and listens to the message that follows.

Essentially, the paging system is a low-powered radio network. It requires no Federal Communications Commission license to operate. Yet, its range permits complete coverage of buildings and grounds.

Electronic equipment needed for the Motorola "Handie-Talkie" radio pocket pager is neatly enclosed in this slim cabinet. Plug-in "Vibrasender" units are located near top of equipment rack. Units are individually tuned to frequency matching one in the paging unit.



At St. Anthony's, such an area covers two multi-story buildings, an annex and a courtyard. Radio paging gives complete communications coverage in these zones, reports Sister Maristella, Hospital Administrator.

With the Motorola radio pager, she emphasizes, personnel can be reached more quickly—response is faster.

Proper care of patients, however, frequently goes even farther than the communications with medical personnel. On many occasions, maintenance people may be needed or emergencies not under either of these classifications may require contact with various members of the staff.

In any event, Sister Maristella says, the radio pager completes such contacts with a minimum of disturbances to persons not involved. Furthermore, the pagers are extremely simple to operate, requiring only a brief demonstration for would-be users.

Pagers also are particularly helpful to the switchboard operator. Pager-carriers can be reached wherever they are on the grounds, and there is no need to keep the operator constantly posted as to their whereabouts.

The radio paging system offers noteworthy economies both in installation and in use. In the St. Anthony network, for example, installation was completed without need for any remodeling. Antenna loops were installed inconspicuously on the outside of the building. Such loops also can be installed within the building. Electronic equipment is contained in a neat cabinet requiring little space.

In keeping with the hospital's policy of the best in service and attention for the patient, officials hope to equip every staff doctor with an individual paging unit.

Eventually, Sister Maristella says, this procedure will eliminate use of the familiar loudspeaker system.

Future plans for expansion of the hospital also include considerations for extending the paging system. » » »

Right, Switchboard operator dials code number signaling St. Anthony staff member equipped with new Motorola "Handie-Talkie" radio pocket pager. She then delivers message which is transmitted instantly to paging unit, wherever it may be in the hospital area.

HOW TO GET FULL VALUE FROM YOUR RADIO SYSTEM

"Two-way radio is a working tool you cannot afford to be without." Who's doing the talking? It might be the operator of a trucking company, a ready-mix entrepreneur, a materials handling engineer, an official of a cab company or a representative of other industries too numerous to mention.

These words have rung through convention halls, have run countless times in the trade press and have even emerged as a primary resolution at seminars involving delegates from various industries who gather to discuss improved methods of obtaining the most from facilities at minimum cost.

Two-way radio has truly taken American Industry by storm. In the various studies of the advantages of this modern means of communication, however, one salient factor has emerged. Two-way radio is only as valuable as the user makes it. The mere existence of an installation does not guarantee its successful use and full economic benefits.

No matter how well the mobile radio system is designed and built, optimum benefits are derived only after dispatchers and drivers are trained in correct radio procedures and use these to the utmost. At least one member of management in a company using two-way radio should become intimately acquainted with all details of the dispatching system. He then can properly supervise its operation, maintain good procedures and evaluate the radio's effectiveness.

As for a training program to achieve the optimum, greatest care should go into the selection and training of a radio dispatcher. It is no exaggeration to state that this one individual will determine whether or not maximum benefits are derived.

Of vital importance is the dispatcher's attitude. He must be "sold" on this new radio method of dispatching for the system to be effective. The dispatcher must be a man able to make quick decisions, remain calm under pressure and make his orders stick. He should be impressed that the instantaneous two-way communication of radio has the effect of projecting his authority into the driver's seat of each vehicle strengthening his potential of control over movements.

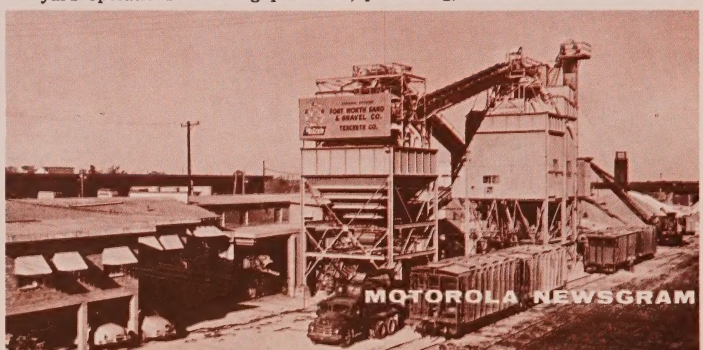
Dispatching becomes a full time job when a large number of vehicles are involved. For very large fleets, the dispatcher may require the assistance of a clerk to handle telephone calls and keep records. During the training of a dispatcher, the concept of control is of fundamental importance. The dispatcher must realize that he, not the driver, is the director of pickup and delivery operation.

As for the technical training of the dispatcher, this indoctrination should be the responsibility of the equipment manufacturer, who should explain system layout, the function of the various controls, microphone techniques and other hints as to good dispatching.

One of the best lessons a beginning dispatcher can get is to observe an experienced radio dispatcher in action. A few hours spent watching an old hand at the mike will do wonders for a new man.

Materials handling is fast, efficient with moves directed by two-way radio.

In operations such as the ready-mix cement industry, two-way radio not only saves mileage and speeds deliveries but also is invaluable in coordinating yard operations involving personnel, processing, trucks and rail switching.



Cab companies learned early that a two-way radio system means better service, less wasted trips, higher earnings.

Well trained dispatchers, properly equipped, are important in deriving full benefit from a two-way radio system.

Of course, obtaining full value from a radio system depends on the drivers as well as the dispatcher. Good habits should be cultivated from the beginning, since radio operation soon becomes a habitual practice.

Correct usage techniques, as well as a semi-technical explanation of the function of the various parts of the system, are best explained to the drivers by representatives of the equipment manufacturer before the system goes into use. The dispatching methods decided by each company will determine when the drivers should call in. At a minimum, they should notify the dispatcher of delays, any "overages-shortages-and-delays" matters and whenever they leave the trucks.

Two-way radio can be life insurance, job insurance and health insurance for the drivers—and should not be construed by them as a method of spying. Reports on road, street and traffic conditions, unusual factory operations can be secured immediately. Aid can be speeded in accident cases.

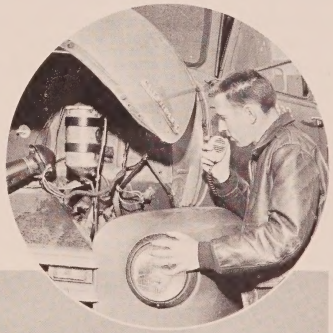
The drivers must understand that decision-making is up to the dispatcher—he's getting paid for the job—and the radio is the best means of letting the drivers know of such decisions. With this understood, the driver is relieved of responsibility for wrong decisions and the dispatcher finds his work much easier.

Drivers should be helped to view the cost of the radio system in terms of a company investment in improved service. In the trucking industry for example, drivers are front men with the customer. When they are sold on the radio's benefits to the customer they will be proud of and talk up this new service tool.

In most cases this pride is present. The driver might be willing to take out a truck with poor compression or a stiff working tail gate. But once accustomed to the convenience of a microphone and loud speaker, he probably will resent driving a truck not equipped with two-way radio.

Your Motorola Communications Representative has had a vast amount of experience with various types of radio systems and dispatching methods. If problems in determining the most efficient dispatching and operating methods do arise, he will be happy to give you the benefit of this experience. His practical pointers have proven beneficial in hundreds of installations.

In getting full value from a radio system, it is necessary that the entire dispatching system undergo critical examination periodically for the purposes of detecting and correcting inefficient procedures. This can best be done by a member of management who is familiar with good radio dispatching methods, yet who is far enough removed from the day-by day dispatching duties to view the operation objectively. With the above factors under control, the radio system will be operated most profitably, with the greatest benefits. » » »



Breakdowns, even in isolated spots, can be reported instantly with two-way radio, sending help to the scene with a minimum of delay. Costly equipment is kept on the road.

Motorola two-way radio equipment installed in this Monon "road engine" means constant and instantaneous communication between crew and other points in the rail network, for safer, more efficient operation.

RADIO ACTIVITY ON THE MONON

Among the time-honored gestures known to man there are perhaps none so familiar as the oft-repeated checking of his watch by the railroad man.

This is far from being a meaningless habit. For the railroad, time is all-important—almost a religion. Whether it involves making up a train, keeping a schedule or maintaining the right of way, the ticking of the clock is the railroad's most relentless taskmaster.

The necessity of getting the most out of every minute is one of the reasons why two-way radio has had such tremendous impact on the railroad industry. Time saved through instantaneous communications is virtually immeasurable—whether it involves contact with a near-by yard or with a maintenance crew or road engine out in the hinterlands.

With two-way radio, the engineer receives switching orders directly.

An indication of two-way radio's importance to the railroad is evident in a statement by D. H. Steiner, superintendent of signals and communications for the Monon road. Using his own company's operations as an example, he points out:

"The countless advantages which have been gained by the Monon since we inaugurated two-way radio communications have been so beneficial to the railroad that authority for radio equipment receives the highest priority in our improvement budget. This will continue until we have complete coverage."

The initial Monon Motorola two-way radio equipment referred to by Steiner included a base station at the railroad's most important terminal in Lafayette, Indiana, and 30-watt radiophones in 12 road engines, two switch engines and four cabooses.

In a continuing expansion of its radio communication facilities, Monon has susequently added radiophones in 26 locomotives and eight cabooses. Latest additions are ten Motorola 64-volt transistor power "Stan-Pac" radio units. In addition to the first base station, similar Motorola-equipped installations have been activated at Bainbridge, Bloomington and Bedford.

The Monon Railroad operates between Chicago and Louisville and between Chicago and Indianapolis, with branch lines to Michigan City and into the coal fields in southwestern Indiana at Midland. Actual Monon ownership lies entirely within Indiana. Entrances into Chicago and Louisville are made through jointly owned terminals.

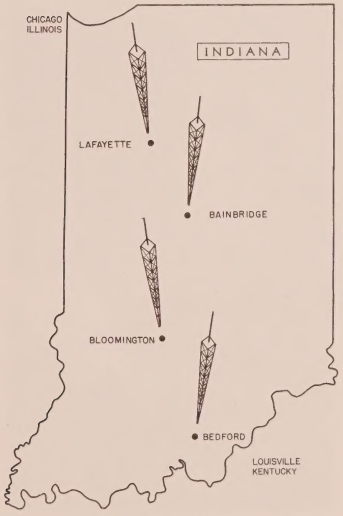
Hoosier terrain covered by the line is characteristically flat in the northern portion. In southern Indiana, however, numerous curves and difficult terrain present certain problems as far as two-way radio operation is concerned. Such terrain problems were conquered through use of the four towers located at strategic points in the network (see accompanying diagram).

The Lafayette antenna is located atop a 90-foot light tower and gives excellent coverage in this area. The base station is so arranged that it can be remotely controlled by the dispatchers and the yardmaster.

This gives the yardmaster direct communications with the switch engines operating in the Lafayette area and affords the dispatchers a means of continuous contact with road engines. Complete success of this original installation in proving itself an invaluable tool for the operating department was the prime mover in installation of subsequent equipment.

Elevation at the site of the Lafayette tower is relatively low, being 550 feet above sea level. To obtain optimum operating conditions, the 105-foot tower at Bainbridge was located on a hill 950 feet above sea level, the highest point between Lafayette and Bloomington.

The tower at Bloomington is actually located atop a hill three miles north of the city and is remotely controlled from Bloomington. In locating the antenna at this point, Monon gained 125 feet of ground elevation. Further height was achieved by erecting a 105-foot tower. The portion of the Monon's line between Lafayette and Bloomington consists of an entire subdivision.



Motorola base station equipment located at the foot of a Lafayette terminal floodlight tower. The station can be remotely controlled by dispatchers and yardmaster.

Stretching its radio communication system still farther southward, Monon selected a high elevation at Bedford and installed its antenna on a 120-foot self-supporting tower.

According to Steiner, the overall system now provides the dispatcher with a means of remote-controlling each of the stations via Motorola "Main-Line" equipment.

With this system, the dispatcher can mute any or all of the base stations connected to his line—or the stations can be left in a standby condition, allowing the dispatcher to monitor incoming messages.

He can select any of the base stations and remote-control them to establish communication with individual radio units within calling distance of any of the stations.

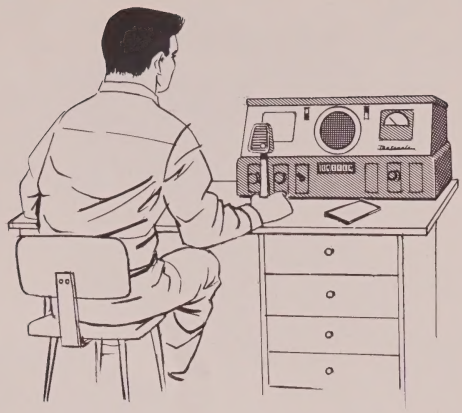
This expanded system evolved from an original Monon radio program plan designed to provide a minimum radio installation which, nevertheless, could be easily enlarged to meet increased needs of service as utilization increased and the need for additional equipment became apparent.

With radio already well-established in its operations, the Monon is experimenting with additional uses of this equipment. Motorola "Handie-Talkie" portable units are carried in cabooses as auxiliary equipment to aid in switching operations.

Radio has even invaded Monon's maintenance of right-of-way facilities. A radio-equipped motor-car has been fitted with a Motorola "Big Voice" audio system as well as a Motorola "Bridge Gang" radio set which booms out instructions and messages to workmen over a wide area.

Motorola two-way radio has provided Monon with the most effective available means of keeping the closest control over manpower and equipment. » » »

Two-way radio installation in one of the Monon Railroad's switch engines.



TWO-WAY RADIO EXPEDITE

HYLAN OIL RELIES ON ELECTRONICS FOR OPTIMUM SERVICE TO CUSTOMERS

Hylan Oil Company of Flemington, New Jersey, is leaving nothing to chance as far as service to customers is concerned. At the same time, the firm is assuring itself of the most profitable operation possible through an electronic modernization program.

One of the basic ingredients of this effort is Hylan's Motorola two-way radio system. This consists of a base station installed in company offices in Flemington and mobile two-way units mounted in the cabs of the company's fleet of service trucks.

Radio has considerably improved efficiency of the company's activities as a distributor for the Texas Company in Hunterdon County, according to Stephen Christy, company president.

"Our sets will more than cover the 15-mile area in which we operate," Christy points out, "and we have instant contact with all parts of the fleet at all times. Trucks can be dispatched to different points without having them come back to Flemington.

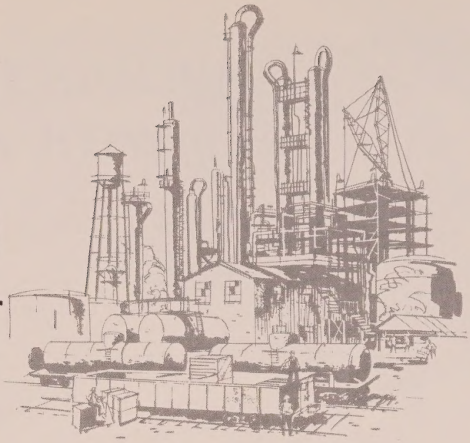
"This saving of 'back-tracking' is reflected in lower operational costs," Christy continues. "Also, we are providing more efficient service for our various customers."

Another device which Hylan has adopted in streamlining its activities is a "degree day" computer. In the terminology of fuel men, degree days are figured by subtracting the daily mean temperature from 65F. For example, if the high for day ratings is 70F and the night low is 30F, the mean is 50, and the number of degree days is 15.

"This computer is much more accurate than the weather bureau statistics on which we formerly had to rely," Christy says. "Like our two-way radio system, it has made a big difference in our operations and has helped in eliminating the expensive overhead of guess-work and wasted time. »

In addition to the best in service which Motorola two-way radio provides for Hylan, company drivers are kept constantly informed of information which pertains to their particular operations. Tiring and useless back-tracking is eliminated. Radio also provides added security for the driver while he is making service calls.

Motorola two-way radio aids in maintaining the Hylan Oil Company's reputation for fast, efficient service.



PETROLEUM DISTRIBUTION

MOTOROLA RADIO HELPS BOOST BUSINESS TO UPWARDS OF $1 MILLION ANNUALLY . . .

George Wolf, Jr., hesitated briefly when asked what advantages he had experienced through use of Motorola 2-way radio, but the pause was only momentary and caused mainly by the fact that he was uncertain as to just where to start.

It seems that the benefits of his 2-way radio system have many facets—almost as many as the truck routes that radiate from the hub of his petroleum product distributing business at Sligo, Pennsylvania.

Certainly, he points out, 2-way radio has contributed largely in boosting his annual gross to upwards of the $1,000,000 mark. This contribution takes various shapes and forms and involves the many operations which are part and parcel of petroleum distribution.

Without *any* hesitation, Wolf tells his customers he can provide them with the best and quickest service possible—and then goes on to prove it. This means continued sales or repeat business and excellent word-of-mouth advertising. Here's how this works:

Wolf's fleet includes tank trucks of 1000, 1200, 1500, 4000, and 4500 gal. capacity, all of which are equipped with Motorola 2-way radio. Each morning, the trucks leave Sligo city for Oil City to pick up a load of fuel oil, gasoline, kerosene, motor oil or related products.

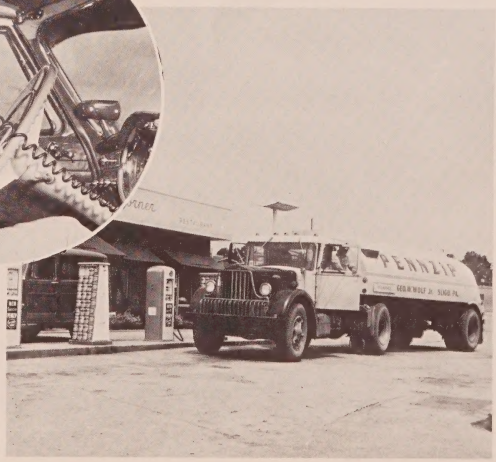
While a driver is in Oil City or its environs, or perhaps returning with a full load, he is naturally in constant contact with the dispatcher, thanks to 2-way radio. Frequently, customers in the area—school bus fleets, heavy equipment users or other purchasers of petroleum products—call in with a "rush" order.

In mere seconds, the dispatcher can be talking to the driver nearest the delivery point, and in the shortest time possible, another customer is happy because of accelerated service. The proximity of Wolf's trucks to the oil fields and his reputation for quick service has also put his firm in demand as a supplier of kerosene for a process known as "Hydrofracting". This involves injecting of thousands of gallons of kerosene into a well as part of a process to increase output.

"From our end of it," Wolf points out, "it means that at any time we can expect someone out in the oil and gas fields to put in a call for large quantities of kerosene to be delivered immediately to some remote destination."

Wolf also emphasizes that maintenance of equipment throughout all of his firm's operations has been considerably lightened and reduced through use of 2-way radio. Likewise, the life-saving potential of 2-way radio also cannot be over-emphasized, according to Wolf. On one occasion, one of his drivers making strip mine and farm deliveries became critically ill. Through use of his radio, help arrived quickly. In all probability, fast action in getting him to a hospital where blood transfusions could be given saved his life. » » »

Left, George Wolf, Jr., using radio which has helped in boosting his business to $1 million annually.



Right, One of Wolf's large tank trucks delivers fuel minutes after a rush call from a station operator.

STAHLMAN INCREASES STRIP MINE TONNAGE WITH MOTOROLA TWO-WAY RADIO SYSTEM

Radios in the trucks and shovels operating in the Stahlman pits permit transfer from one stripping operation to another in a matter of minutes. Personnel also can be located more easily with a minimum loss of time, both for routine and emergency calls.

"Two-way radio has assumed such importance in our operations that we wouldn't relish working without it." So does W. Persh Stahlman, operator of the Stahlman Coal Co. in Corsica, Pennsylvania, state his conclusions on the value of this modern means of communication to his business.

Constant contact with the superintendent simplifies work of the crane operator—puts supervision in the cab.

He adds further that radio has resulted in more tightly knit operations, making it possible to increase tonnage without additional labor. Other benefits, which Stahlman has accrued through the use of radio in his coal stripping operations, have been better personnel relations, reduced maintenance costs and more continuous operation of expensive equipment that must be kept producing if obligations are to be met.

Stahlman's customers are largely power companies. However, individual carloads of coal are also shipped to dairies and other companies that have fairly large heat and power requirements. Whatever his business, the coal user wants a dependable source of coal—on schedule—to keep him happy. Motorola two-way radio has aided considerably in accomplishing this, and made it possible to take on more accounts without qualms as far as meeting peak demands is concerned.

"The year before we installed Motorola two-way radio we shipped about 380,000 tons of coal," Stahlman points out. "The following year, with the same overhead and labor, we produced about 400,000 tons for shipment. In one month alone, that fall, we produced nearly 62,500 tons, which was an increase of between 5000 and 8000 tons over the same period the preceding year. This increase came about as a direct result of the installation of two-way radio, and we readily admit that we depended heavily upon this modern means of communications to accomplish it."

Stahlman pits are all within 10 miles or so of each other, so distance isn't a primary communications problem. The trouble lies in the very nature of pit operations. For example, a foreman is looking for someone in a pit.

As he enters at one end, the person he is looking for can be going out the other end, hidden from his view.

If a dozer is needed in one pit, even though there may be one in an adjacent pit, it might take hours to get this need satisfied. Stahlman recalls instances where it took about three hours to begin or to transfer an operation from one pit to another, all because of insufficient means of catching up with the person immediately wanted. "In many of our operations, you are literally in a hole in the ground. Without radio, communications are limited to about as far as you can see," Stahlman emphasizes.

With radio communications in a fleet of some 20 units of pit trucks and machinery, Stahlman has cut contact time down to minutes and even seconds. In this way, expensive equipment keeps operating a maximum amount of the time, rather than standing idle needlessly. Considering that equipment and manpower costs so much per hour, idleness is just so much money down the drain.

Because of these improvements, a natural expectation by Stahlman is that production output will continue to increase. Three big drag-lines, each capable of biting off six cubic yards at a stroke, are being supplemented by even larger drag-lines.

Even with equipment operating around the clock when possible, shut-down time is kept to a minimum because each operator has two-way radio at his command so that he can quickly call for parts or have repairs made when equipment breaks down. This is especially true at night, when operating with a minimum of personnel. The lone operator benefits by being able to use the radio.

As far as company personnel is concerned, a definite improvement in morale became evident after installation of the radio system. Men working in the pits know that their families can get in touch with them in a matter of minutes if necessary. They know that messages from home can be relayed and appreciate this. Naturally, they feel more at ease, because if there is any crisis, they will be able to take care of it promptly.

For management, Motorola two-way radio turns a car into an office on wheels. The superintendent is now able to call the office and solve a problem in the field immediately, a problem that often took half a day to resolve in the past, move a scraper in for road preparation, get hold of a welder for a minor or major repair to equipment, or send a car in to take out a man who was hurt while on the job. To repeat, such incidents as these formerly meant extensive down time and workers uncertain as to what they were to do next.

Two-way radio saves backtracking and wasted trips for Stahlman Co. drivers.

"Two-way radio has solved many communications problems for us," says Stahlman. "We look forward to even more benefits in years to come. Better direction of stripping operations means more dollars for all concerned, and that's what we are in business to do—produce more, more profitably." » » »

Boosted tonnage through use of two-way radio is exemplified by this busy loading station.

Motorola two-way radio minimizes down time for this drag line which operates around the clock.

"POWERFUL MEDICINE" FOR

Dr. C. N. Sprinkle (left) and his son, Dr. L. T. Sprinkle find Motorola two-way radio a useful tool in rigorous country doctor duties.

Mrs. C. M. Spidle contacts her veterinarian husband via Motorola two-way radio to relay an urgent message from a South Dakota farmer.

Eras come and eras go. The surrey with the fringe on top has become merely a curio, and the helicopter and rocket hold sway. But there are some segments of society that continue in as vital roles today as they did years ago.

Interesting examples are the practitioners of medicine in the country's vast rural areas. While the venerable "country doctor" is perhaps the more commonly known of these, he has a noteworthy counterpart in the doctor of veterinary medicine.

Increasing numbers of these medical men whose practices are predominantly in rural districts are turning to Motorola two-way radio as a means of solving what has always been a difficult communications problem.

There is hardly a veteran member of either of these professions who cannot recall times when two-way radio would have saved anxiety, grief and invaluable time. These were the instances where they would return from a long and arduous vigil in sick-room or barn—many times a considerable distance from home or office—only to learn that another urgent call had been received from someone in the area that they had just left. There was nothing to do but pack up and go back.

Two-way radio has eliminated, in the majority of cases, the need for such back-tracking, thus saving travel time, providing quicker response to calls and making the practitioner's life a less strenuous one. These users of Motorola two-way radio many times regard the adaption of radio to medical practice as of importance rivaling the development of new medicines and medical techniques.

Actual instances such as the following illustrate graphically the importance of two-way radio to the country doctor: Picture a young rural lad who had been accidentally hit by a blast from a shotgun while on a hunting trip on a mountainside in rough backwoods country.

By the time the victim was taken to the Valley Clinic and Hospital at Bat Cave, North Carolina, an hour had elapsed—he had lost a great deal of blood and was near death. It was now 6 p. m.

Dr. William Burch, a general practitioner who mans the clinic, happened to be out having his auto serviced when the patient was brought in. However, the clinic immediately contacted Dr. Burch via the two-way radio system in his car. Normally, without knowing the doctor's exact position, it would have taken some 30 minutes to reach him.

As Dr. Burch points out, the boy could have died in that critical half hour—but he was saved, thanks to two-way radio.

Similar experiences can be recounted by Dr. L. T. Sprinkle of nearby Weaverville and Doctors Otis Duck and W. E. Powell who practice together out of Mars Hill, North Carolina.

Dr. Sprinkle, a second generation country doctor, practices with his father, Dr. C. N. Sprinkle, 68, who has spent the greater part of his life as a rural doctor.

The elder Dr. Sprinkle recalls uncounted instances during the horse and buggy era (as well as in the days of the early auto) where he was away from the office for days at a time waiting out the stork. He'd spend another day or so in making the round trip.

Thus deployed, the doctor was out of touch completely. He had

RURAL PRACTITIONERS

no way of knowing how his other patients were faring and was in no position to quickly react to emergencies. If an emergency arose, someone had to get on a horse and fetch the doctor.

The younger Dr. Sprinkle began his Weaverville practice in 1948 and installed his radio system in 1954, the first MD in the area to do so. His system includes four Motorola mobile two-way radio units, one remote control unit in his office and another in his home.

No matter where he goes on a call, he is in constant touch with his home or office and is in a position to answer emergency calls immediately. The system also keeps him from the discouraging need of "doubling back" on himself—and this happened before two-way radio was installed.

He also recalls instances of emergency calls coming in from rural areas where he has been able to reach the scene before the person who left the house to place the call had returned. These were situations where he happened to be nearby in his car and was alerted via radio.

Doctors Duck and Powell are equally aware of the benefits of Motorola two-way radio in their practice, singling out particularly its value when making calls in some of the most remote country conceivable.

Like the majority of their colleagues, their offices are closed at night. But, and also like other doctors utilizing two-way radio, they have Motorola base station control units in their homes. When someone calls and either doctor is out on the road his wife quickly contacts him via radio.

Now, what about the veterinarian? To the city-dweller breezing through the countryside on a Sunday jaunt, livestock may be just so much more potential beefsteak, lamb stew or pork chops.

For the stockman, however, these creatures are something else again. Each animal represents a considerable investment—one that won't pay dividends until the animal is marketed. An ailing or injured steer or porker is of as much consequence to the stock raiser as a machine breakdown is to an industrial concern.

Despite their rugged constitutions, these animals do get sick or are hurt. To protect his investment, the owner may find it necessary to rely on the skills of the veterinarian to effect a cure.

The vet has no set hours—no time during which he might not be called upon in an emergency. Even routine calls may come from widely scattered points in the territory embraced by his practice. Prompt, reliable communication with clients is essential.

This need for keeping close contact with the many livestock producers in his area around Preston, South Dakota, prompted Dr. C. M. Spidle to install a Motorola two-way radio system.

His equipment consists of a base station located in his home and a mobile Motorola two-way radiophone in his auto. While the doctor is out making calls, his telephone is manned by his wife. Via two-way radio, she can relay incoming messages instantaneously to her husband. The previous method of locating the doctor during his rounds was to make a series of telephone calls, or he would keep headquarters posted as to his whereabouts.

With two-way radio, Dr. Spidle can either give vital information, which in turn is relayed instantly by his wife, or in instances where his personal services are required, he immediately visits the client.

With two-way radio, he eliminates much wasted time which would otherwise be required returning to areas he may have just left or in making personal calls which could have been handled in other ways. Mileage saved in this way also is considerable. » » »

Telephone calls to his home, an important part of Dr. Duck's practice, can be relayed by the doctor's wife immediately on receipt to the doctor.

Dr. Otis Duck can talk with either office or home via two-way radio while driving, after completing a visit or prior to his next call.

A message from a patient is sent out from the office of Doctors Otis Duck and W. W. Powell, medical practitioners at Mars Hill, S. C.

QUALITY SERVICE . . . FASTER . . . with TWO-WAY RADIO

Astor Electric Utilizes Speedy Communications To Augment Reputation for The Best In Service

Emil Staley, Astor service man, checks with the office via Motorola two-way radio before proceeding to his next call on a customer.

"Our policy since the founding of our business has always been to treat customers as valued clients who in every instance are entitled to the finest, fastest, fairest service possible."

So does Fred G. Astor sum up the basic reasons behind the success of Astor Electric Service, Inc., of Miami, Florida, which he serves as executive vice president.

"Our constant striving to give prompt, 24-hour-a-day service, fair prices and a high degree of integrity in all transactions has made Astor the largest firm of its type in Greater Miami," he continues.

Since its founding in 1932, the company has grown to more than 4000 active accounts embracing a wide variety of activities in the electrical field. Astor's speciality is the technically difficult rewiring and repair jobs in commercial, residential and industrial applications.

In fact, using the slogans, "Quality Doesn't Cost, It Pays," and "Ask Your Neighbor," Astor invites calls for anything in the electrical field.

One of the most important steps taken to assure prompt service was the installation of a Motorola two-way radio system. A two-base station system with individual antennas on 100-foot towers was installed to provide necessary communications range.

Sixteen trucks were equipped with Motorola two-way radio sets, permitting workmen to talk to either base station.

All supervisors' cars, delivery trucks and service department vehicles also are radio-equipped, assuring an almost immediate response to emergency calls regardless from which area in South Florida the calls may originate.

"Installing a two-way radio system seemed the wisest decision we could make, after we had made a study of the tremendous growth of our market area," Fred Astor says. "Since this choice was made, two-way radio has helped considerably in enhancing our established reputation for prompt efficient service." » » »

Louis Andrews (left) dispatches one of the Astor radio-equipped trucks while checking a map for location as R. L. Bibee relays an emergency call.

MICROWAVE SOLVES GREENWOOD TELEPHONE RIGHT-OF-WAY PROBLEMS

Exterior of Greenwood Telephone's Ware Shoals exchange, showing tower and passive reflector. This station is the latest of Greenwood's automatic exchanges to install Motorola microwave equipment.

A right-of-way problem on planned land line construction in 1953 first led the Greenwood Telephone Company of Greenwood, South Carolina, to the consideration and use of Motorola microwave. Now, after four years of service, this link has performed so well that the company is adding another to meet current modernization plans.

The firm serves Greenwood, Ware Shoals, Troy and several other surrounding towns in the Northwest section of South Carolina—about 13,000 telephones in an area of roughly 1500 square miles.

In 1953 plans were made to supply toll trunks between Greenwood (a toll center) and Troy. Conversion of Troy from an operator exchange to an automatic central dial office was necessary to coordinate with toll trunking to Greenwood.

Land line construction, it was found, would require unobtainable right-of-way through a forest preserve area. To avoid this area would mean prohibitive construction cost. However, detailed investigation and study by Motorola microwave engineers of the problems involved, produced an economically satisfactory solution to alleviate the right-of-way problem.

Motorola microwave equipment to meet initial needs of one RF channel and four voice channels was finally selected. Emergency standby power equipment was supplied. However, available microwave performance figures indicated no need for standby microwave equipment.

The decision to operate in this manner has met with satisfactory results. The outage time has averaged less than two hours per year; the maintenance bill for the first two years of operation was $218.00, and has remained at an extremely low figure since that time.

Greenwood also operates two Motorola mobile telephone systems, one in the 30-40 megacycle band for highway mobile service, and the other in the 152-162 megacycle urban mobile band.

"Although these systems have had constant usage for the past eight years, they have rendered excellent service," C. Bruce Barksdale, company president points out.

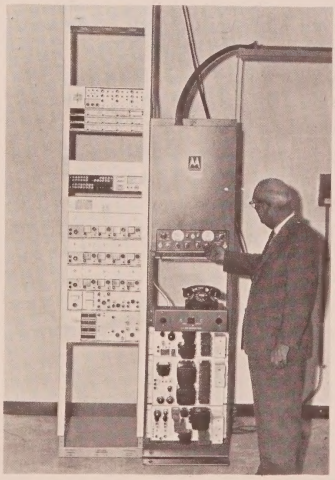
The adaptation of inter-toll dialing through the Greenwood exchange to Troy over the microwave system has been 100% perfect. The same outstanding service to the new Ware Shoals exchange is anticipated.

The Ware Shoals exchange is the latest dial automatic exchange with a Motorola microwave installation of 12 voice channels, 11 being used for toll and operator trunks and the other channel providing six telegraph channels for tele-typewriter circuits to the Riegel Textile Corporation at Ware Shoals.

This second microwave system is a one-hop system, approximately 18½ miles long. For the gently rolling terrain between the Greenwood and Ware Shoals towers, only a 140-foot tower at Ware Shoals was required.

The passive reflectors mounted on the towers are served by "dish" antennas mounted on the roof to keep the antennas near the microwave RF cabinets. This greatly simplifies maintenance and reduces use of waveguide facilities.

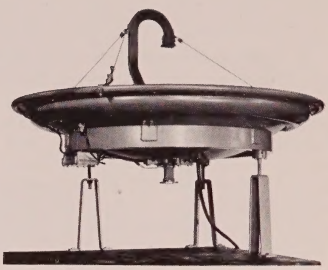
The Greenwood company is enthusiastic about the performance of Motorola Microwave Systems and plans future utilization of such where the occasion presents itself.



Motorola MR-10 microwave RF equipment at Ware Shoals, with multiplexing facilities at the left.

MOTOROLA MICROWAVE ANTENNA SYSTEMS

Paraboloid antennas and tower mounted reflectors for operation in the 6000 mc frequency range.



Usually high antenna gain from practical size antenna components is a major advantage of Motorola Microwave's 6000 mc frequency range. As a consequence, it is possible to use a highly reliable, low power transmitter such as the reflex klystron. Operation achieved is equivalent to that of a high powered transmitter, but is acquired at lower cost and with greater reliability.

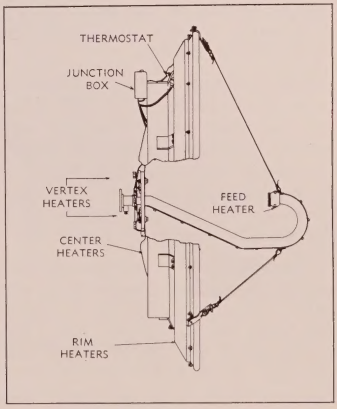
Motorola's philosophy in frequency band selection has proved correct over the years. Operation at 6000 mc, in addition to permitting high gain antennas, permits the use of tower mounted 45° passive reflectors for elevating the radiated signal without elevating the antenna. This practice keeps all active components within easy access at ground level and avoids any use of transmission line between equipment and tower top. Tower mounted reflectors require virtually no maintenance and serve to increase the overall gain of the antenna system in most instances.

PARABOLOIDS

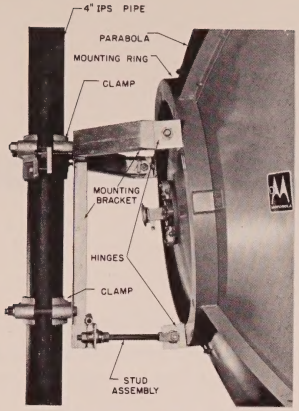
The antenna used at 6000 mc is a paraboloid shaped, spun aluminum "dish" excited by means of a waveguide horn located at the focal point of the paraboloid. The energy emanating from the horn is concentrated into an extremely narrow beam by the paraboloid. This concentration of energy results in a radiated signal equivalent in strength to the signal of a very high power source radiated from an omni-directional antenna. Beamwidths achieved in Motorola's microwave antennas range from 2.5° (between half power points) for the smallest antenna, with an accompanying gain of 35.2 db, to 1.0° and a gain of 44 db for the largest size paraboloid or dish.

If no elevation of the signal is needed to secure the necessary line-of-sight plus ½ Fresnel Zone clearance, the paraboloid may be mounted in the vertical plane and used alone. If elevation is required, a horizontal mounting is used for the paraboloid and the energy directed at a tower mounted passive reflector whose face is 45° to the horizontal. The tower mounted reflector efficiently changes the direction of propagation from the vertical to the horizontal direction. The resultant overall signal gain from such a combination will generally be greater than that of the paraboloid antenna alone.

Paraboloids are available in 4 ft., 6 ft., 8 ft., and 10 ft. diameters. The greater the diameter of the paraboloid, or dish, the greater the concentration of energy, resulting in increased antenna gain. In most installations 4 and 6 ft. paraboloids fulfill the requirements for all practical tower installations. The 8 and 10 ft. dishes are used in vertical dish installations almost exclusively. The gain achieved in 8 and 10 ft. paraboloids is comparable to that achieved in similar size reflectors illuminated by smaller parabolic antennas at proper reflector-dish spacings.



For cold climates Motorola microwave antennas are available with heaters. Heater details for a 4′ paraboloid antenna are shown.



A three point suspension system is used to clamp 4' or 6' parabolic antennas to a 4" IPS pipe mast or pipe frame. Two hinge points and a threaded adjustable arm permit elevation adjustment of ±5°. Azimuth adjustment is through 360°.

HEATERS

All paraboloid reflectors or dishes can be provided with optional heaters or de-icers for use in winter weather to keep the antenna clear of ice and snow. This insures proper operation under all weather conditions. Proper operation of a paraboloid may be jeopardized if the reflector is allowed to become coated with ice. The heaters consist of heater wires moulded into a fiberglass blanket which is attached to the back of the dish. The outside fiberglass blanket is completely weatherproof. Heaters at the junction of the waveguide and dish surface and on the horn mouth prevent ice formation at these two important areas.

A thermostat switch closes when the temperature of the dish drops to +35°F causing the heaters to operate. Power capacity of the heaters ranges from 600 watts for the 4 ft. dish to 3600 watts for the 10 ft. dish. In horizontal dish installations a drain hole is drilled at the low point in the dish and a nipple connected to a plastic drain tube carries off the accumulated water.

TOWER MOUNTED REFLECTORS

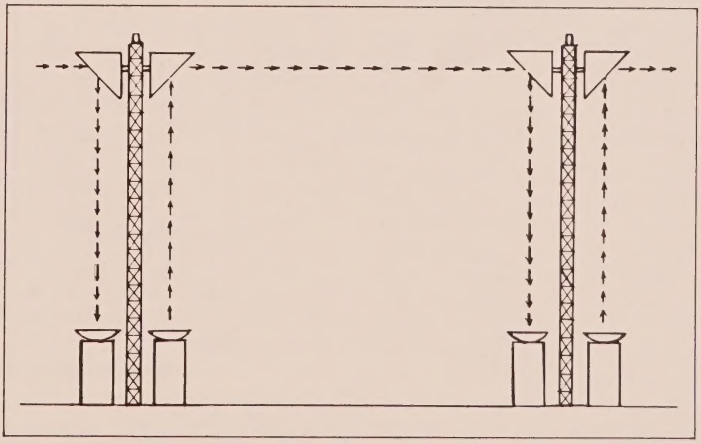
Tower mounted passive reflectors are available with face areas 6 x 8 ft., 8 x 12 ft. and 10 x 15 ft. The particular reflector used depends upon the gain required, the size of dish used, and the dish-to-reflector spacing. The gain to be achieved in the antenna system will usually dictate the particular components necessary. A given combination of dish and reflector can be used in a number of dish-to-reflector spacings but generally provide maximum gain at a particular spacing distance for a given frequency. At a different frequency the combination will give maximum gain at some slightly different dish-to-reflector spacing. The selection of dish and reflector sizes is made so as to achieve necessary gain at the particular operating frequency being used. Increasing the reflector and/or dish size does not necessarily increase the antenna system gain.

The gain achieved in an antenna system provides a sizeable portion of the gain required to overcome the space losses within the given path. Gain achieved in this manner is much less expensive than that obtained by increasing power levels in the electronic circuits. Increased power levels in the electronic circuits are accompanied by increased complexity which decreases reliability, compared to the conservatively operated reflex klystron with 100 milliwatts of RF carrier output.

PARABOLOID MOUNTING

Motorola antennas can be mounted on virtually any rigid roof or vertical surface through the use of a suitable mounting kit. A stud mounting kit provides ±5° of elevation adjustment for an antenna mounted horizontally on a roof or vertically on a wall. Two special tilt mounts are available for mounting antennas at angles greater than 5° from the horizontal or vertical. Mounting kits are also available for attaching vertical antennas to existing pipes. A pipe mount kit can be utilized on a roof top to provide vertical mounting.

Because of the narrow beamwidth of Motorola's antennas, the mounting structure must be rigid. Sway should be limited to two degrees or less. Final mounting adjustments are made by balancing the received signal "dropoff" on both sides of maximum. This results in maximum protection against signal loss from wind loads and other phenomena which might cause antenna twist or sway. » » »



Passive reflectors change direction of microwave signal, permitting radiating paraboloids to be mounted at ground level, obviating need for long waveguide runs.

service hints

PREVENTING RECEIVE-AFTER-TRANSMIT DELAY IN EARLIER "P" SERIES "HANDIE-TALKIE" RADIOPHONES

A slow recovery of receive-after-transmit condition may be encountered in some of the earlier "P" Series "Handie-Talkie" units incorporating the NU138 Battery Supply. This condition is primarily an inherent characteristic of the Nickel-Cadmium Power Supply. On release of the push-to-talk key a delay path in the power supply sustained a transient decay of the RF carrier, blocking the receiver for a few seconds.

A slight wiring modification has been incorporated since May, 1957, in all Model Series of NU-138-5, and above, to eliminate the possibility of the above condition occurring. This modification utilizes a pair of existing and unused contacts on the power supply K101 relay to interrupt the B+ after each transmission so that the transmitted carrier is taken immediately off with the release of the push-to-talk key instead of allowing a possible transient decay time.

This wiring modification may easily be effected for the earlier NU138 to NU138-4 Model Series as follows:

1. Refer to Figure #1. After modification of the NiCad Power Supply, this partial schematic should be used as a reference to correct the instruction manual power supply schematic diagram.

2. Remove the NU138 Series Power Supply from the housing. (Two mounting screws, one at each end of the chassis, hold the chassis to the housing).

3. Reference the red-with-white-tracer lead, connecting from pin #5 on the J104 connector through the black vinyl tubing to the bottom of lug #2 (junction of the 56 ohm resistor and 5 MF capacitor) on the large 22 lug terminal board. Disconnect this lead at the 56 ohm resistor—5 MF capacitor junction point and reconnect to terminal #12 of the K101 relay.

4. Connect a short red-with-white-tracer lead from terminal #11 of the K101 relay back to the 56 ohm resistor—5 MF capacitor junction point. » » »

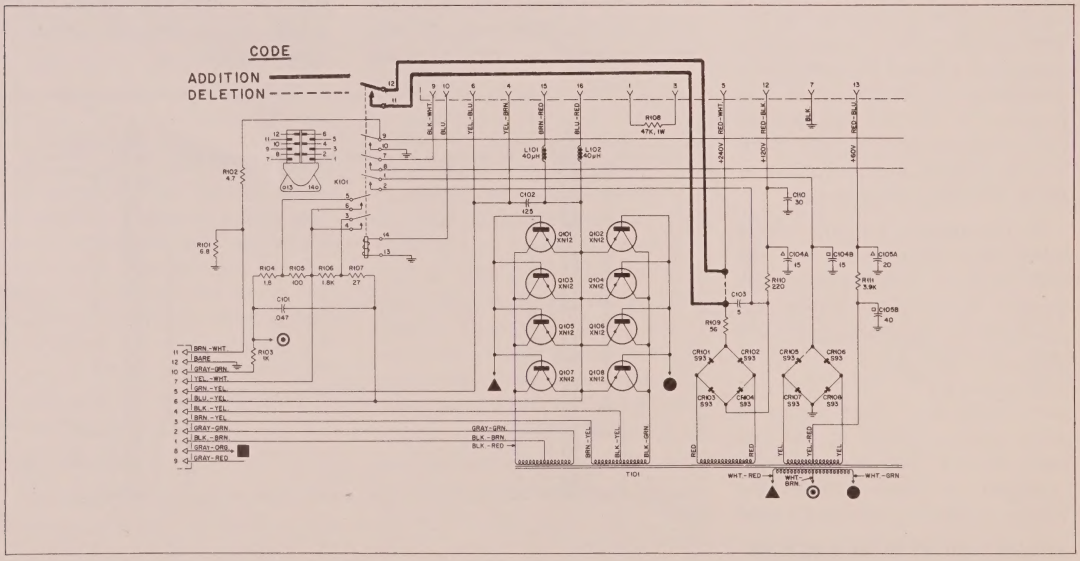
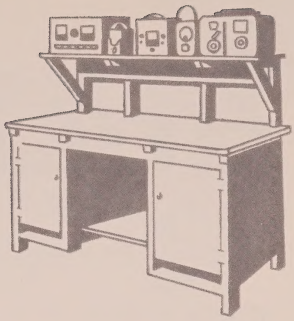


Figure 1.
Partial schematic of NU138 nickel-cadmium power supply showing modification to eliminate delay in receiver recovery.

and shop notes



USE OF LARGER BATTERIES IN THE NU125 BATTERY PACK

The NU125 Battery Pack is incorporated in the "H" Series "Handie-Talkie" Radiophone units and is designed to accommodate the Burgess K-45 type battery for the B+ source. However, in an emergency, or in the event the above type batteries are not readily available, other somewhat larger type batteries (i.e. Eveready 457, General 172, etc.) may be incorporated on completion of a slight modification of the battery pack, as follows:

1. Remove the two rubber-sponge pads in the B+ battery compartment—one in the bottom of the battery pack housing and one on the underside of the aluminum hold-down lid. These pads are glued on and may be removed by simply pulling them loose.

2. Pull the black-vinyl covered battery lead upward until the rubber grommet on this lead is free of the metal slot.

Removal of the rubber pads and clearing of the battery lead will now permit installation of the larger type B+ batteries, provided these batteries are inserted such that the snap-on terminals on top of the batteries face each other when installed in the case.

INTERMITTENT 5 MFD ELECTROLYTIC CAPACITORS

Among the more difficult service problems to diagnose are intermittents, more particularly intermittently open capacitors. Here are two examples:

1. Failure of capacitor Part No. 23K844461 which is used for coupling to the "Vibrasponder" units in "Private-Line" receivers will cause the receiver to become insensitive to properly coded messages.

2. Failure of capacitor Part No. 23A890624 which is used in "G" transmitter and receiver audio circuits will cause cathode degeneration with resultant loss of audio gain.

If the symptoms described are encountered in the units mentioned, check the 5 MFD electrolytic capacitor and replace if defective. Although replacement capacitors carry the same part number, internal improvements have been made for longer life. » » »

GENERATOR FILTERS

The P-346 Generator Filter assembly was originally designed for 6-volt *only* operation, incorporating a 1200 MF electrolytic capacitor rated at 15 dcwv.

With the advent of 12 volt electrical systems, the above capacitor was changed to a 25-volt rating, making the filter assembly suitable for both 6 and 12-volt operation. The model number was subsequently changed to P-346-1 and the exterior case stamped for 6 or 12-volt operation.

It should be remembered, therefore, that the P-346 Filter assembly cannot be reliably transferred from an older 6-volt car to a vehicle with a 12-volt electrical system. In cases of P-346 filter transfers to 12-volt vehicles, the lower voltage capacitor has been known to "open up" on the higher primary voltages.

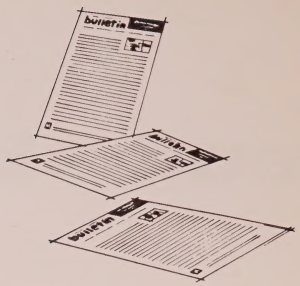
Mechanical and electrical considerations do not permit exchanging the capacitor in question in order to modify a P-346 to a P-346-1. » » »

"SQUELCH BURST" PROTECTION FOR TA141 RECEIVERS

Addition of a single component in the 450-470 mc TA141 Series receiver provides added protection from audio transients causing momentary "squelch bursts" at the receiver speaker. Investigation of instances where this condition occurred after a voice transmission disclosed a slight delay in the cathode bias voltage of the first audio stage with respect to the plate voltage. Since plate voltage is re-applied immediately after a transmission, the delay in bias permitted a momentary "burst" at the speaker.

The above delay in bias is, essentially, the result of the time constant introduced by components R156 (27K) and C170 (5 MF) in the cathode of the first audio stage—V114B. Addition of a 3900 MMF capacitor (Motorola Part No. 23K837996) in parallel with C162 (800 MMF) will delay the audio signal so that it corresponds with the delay in cathode bias voltage, providing ample protection from the above condition. » » »

f.c.c. BULLETINS



Excerpts from publications of and about the Federal Communications Commission

SPLIT CHANNEL ACTIONS

Applications for the "split-channel" frequencies made available in the Commission's "first report and order" in Docket #12169 (see NEWSGRAM, Nov.-Dec., 1957) may now be filed with the Commission. Authorizations are to be issued after April 1, 1958.

A "second report and order", announced Feb. 13, makes available split channels in the 150 mc and 450 mc bands allocated to common carriers. Eleven new channels—5 in the 150 mc band and 6 in the 450 mc band—were added to those presently available to common carriers who operate landline telephone systems. Additionally, six new channels for two-way miscellaneous common carriers (three in each band) were made available. These channels are to be assigned immediately to applicants using equipment meeting narrowband standards and who submit a proper engineering report clearly indicating non-interference to stations operating 30 kc or less removed from the proposed assignment.

In the Land Transportation Radio services:

The *Motor Carrier Service* will have five frequency pairs on an exclusive basis—452.65-452.85 mc (base), 456.65-457.85 mc (mobile).

The *Railroad Radio Service* will have two frequency pairs on an exclusive basis—452.90-452.95 mc (base), 457.05-457.50 mc (mobile).

The *Taxicab Radio Service* will have ten frequency pairs—452.05-452.50 mc (base), 457.05-457.50 mc (mobile).

Both pairs of frequencies in the 450-460 mc range—452.55-452.60 mc (base) and 457.55-457.60 mc (mobile)—made available to the *Automobile Emergency Radio* service shall be used only by stations operated by or on behalf of automobile clubs, not public garages.

In addition, five frequencies—27.235-27.275 mc — are available for base, mobile and operational fixed stations of all the Land Transportation Radio services. »

ABOVE 890 MC HEARINGS CLOSED

The oral phase of the FCC's investigation to determine future allocations and usage policies for the microwave portion of the radio spectrum (890 mc and above) closed after 29 days of sessions, but is still subject to later re-openings.

Among final EIA spokesmen, D. E. Noble, Motorola, Inc. Executive Vice President, again called for "freedom of choice" by microwave users, while other EIA witnesses discussed the association's proposals for microwave system engineering which they contend would avoid any frequency shortage, at least for a decade or more. » » »

CONELRAD FOR STORM WARNING

The Federal Communications Commission, the United States Air Force and the Weather Bureau are making it possible for the CONELRAD national defense alerting system to serve an important peacetime use by disseminating emergency weather bulletins, particularly seasonal hurricane warnings along the coasts and information about inland tornadoes, floods and other acts of nature endangering public life and property.

By an order adopted December 5, 1957, it is enabling all broadcast stations (AM, FM, and TV) to use, during licensed hours and on their regularly assigned frequencies, the CONELRAD attention signals preparatory to the broadcast of Weather Bureau emergency warnings on a condition of immediate danger to life and property. These signals will trigger-off CONELRAD alert receivers which provide automatic warning to FCC licensees, as well as to law enforcement agencies, industrial plants, schools, etc., which possess receivers designed to receive the warning tones.

The peacetime utilization of the CONELRAD alerting system for this purpose grew out of needs emphasized by Gulf Coast hurricanes and by tornadoes in the Plains states.

The resultant plan, it is believed, will provide a worthwhile service to the general public as well as to all radio services. It permits additional receivers—both those specifically designed to receive CONELRAD signals and ordinary receivers which can be economically modified or otherwise adapted for the purpose—to be installed in public, business and other places which require quick and authentic information about serious weather conditions. For example, such receivers at schools will permit adequate warning and, at the same time, overcome telephone line jamming or overloading which may occur in severe weather. In cases of extreme seriousness, the population of an affected area may be warned to take cover, even at night.

What is more, this action looks to a very useful and beneficial secondary peacetime function by a system primarily designed for a wartime function. » » »

new PRODUCTS

Two new audio devices effectively utilize the transistor for compact size, low current requirements and long dependable service.

"POWER VOICE" MEGAPHONE

A new "Power Voice" Megaphone developed by Motorola has been designed for maximum voice range while retaining characteristics of light weight, compactness and ready portability. Capable of 15 watts audio output power, the unit employs six transistors in the amplifier portion to keep weight and power requirements to a minimum. Ten standard "D" flashlight batteries supply all the necessary operating voltage.

Transistorized

With vacuum tubes eliminated, there is no need for "warm-up", and current-consuming "standby" time is unnecessary. Only when the microphone button or trigger switch is operated is there any current drain. With appropriate cable accessories, supplied optionally, the "Power Voice" Megaphone can be powered by external 6 or 12 volt batteries.

Portable

A demountable, dynamic microphone connects to the megaphone through a spring-coil cord, thus permitting operation while the microphone is detached. A pistol grip provides ease in handling. The megaphone can also be carried suspended from the shoulder by means of an adjustable carrying strap provided. The megaphone can easily be adapted for public address operation: it can be used singly or in pairs, and can be remotely operated up to 50 feet from the microphone. » » »

"BIG VOICE" POWER SPEAKER

Another major advance in audio equipment is the "Big Voice" Power Speaker recently introduced by Motorola. Consisting of a dash-mounted control unit and outside-mounted cast aluminum speaker, the "Big Voice" Power Speaker extends the effectiveness of two-way mobile radio by thousands of feet. As an accessory to the radio equipment, the unit can be switched to utilize the weatherproof outside speaker to "broadcast" received messages blocks away from the vehicle, if necessary. It will also accept the microphone input, by-passing transmitter circuitry, making it ideal for use as a public address system. Messages delivered into the microphone, emanate only from the double re-entrant horn speaker. While used in this manner, incoming messages can still be received over the mobile speaker. The "Big Voice" unit can also be switched off to allow normal transmitting and receiving over the mobile set.

The "Big Voice" Power Speaker and control unit are fully transistorized. Five transistors, three in the control unit, and two in the speaker amplifier, provide economical operation, minimum current drain and long dependable service life with maintenance requirements held to a minimum. The speaker is well suited for applications characterized by high ambient noise levels or in instances where drivers must hear messages when they are considerable distances from their vehicles. The powerful transistorized amplifier used in the "Big Voice" speaker overcomes traffic, wind and machinery noises and extends hearing range thousands of feet. The equipment is available (1) as a power speaker only, replacing the present dash-mounted speaker; (2) as an accessory to present mobile systems including both the speaker and the control unit; and, (3) as a complete "Big Voice" radio system, including two-way mobile radio, control unit and power speaker. » » »

New transistorized "Power Voice" Megaphone with full 15 watts audio output can be heard thousands of feet away.

"Big Voice" Power Speaker for radio equipped vehicles consists of dash control unit and outside mounted cast aluminum speaker. Driver has option of setting speaker to "broadcast" incoming messages, using it as a public address system, or switching it out of service until needed.

POWER TRANSISTOR AND POWER AMPLIFIERS

by **Hugo Korn** — Applied Research Department

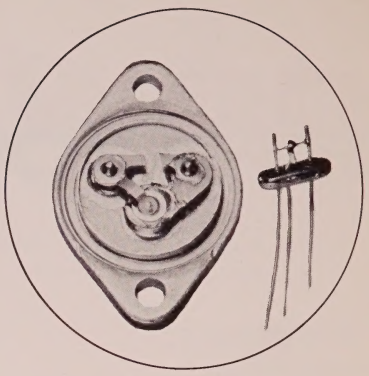


Figure 1.

A preceding article explained the operation and application of low power audio transistors. These applications included single stage audio amplifiers, multi-stage audio amplifiers and oscillators.

This article concerns a specialized type of transistor used as a medium and high power amplifier, some of the unique features of its construction and some of the principles and applications of audio power amplifier circuits. A comparison of the structure of a power transistor and a low power unit is shown in Fig. 1. Close examination of the power transistor reveals that one of its electrodes, usually the collector, is both mechanically and electrically connected to the mounting base. This connection is made for the simple reason that a power transistor must dissipate large amounts of power without excessive temperature rise. A power transistor is usually mounted on a large metal surface (heat sink) which conducts heat away from the collector through the above-mentioned connections.

The temperature to which the collector junction rises is an important limitation in the operation of a power transistor. In the case of high dissipation in the collector junction, the temperature of the junction may be appreciably higher than that of the mounting base, due to the thermal (heat) resistance of the materials between the collector junction and the mounting base. In most cases, the thermal resistance of a material is proportional to its electrical resistance so that good conductors, such as copper, are used extensively in the mechanical construction of power transistors. However, the semiconductor material from which the transistor is made has a much higher resistivity than copper to both thermal and electrical flow. This results in a substantial portion of the temperature differential between collector and mounting base occurring in the collector structure of the transistor.

The maximum recommended junction operating temperature is usually in the vicinity of 90°C (194°F). This value is not determined by physical destruction of the transistor, such as might occur by melting or changing the alloy structure of either the emitter or collector junction, but rather by the gradual deterioration of performance known as "aging".

The maximum permissible collector junction dissipation is determined by the ambient temperature. Since the energy dissipated in the collector junction contributes to the temperature rise, if the ambient temperature (temperature of materials surrounding the transistor) were already at the maximum junction value, we could not allow any additional temperature rise due to collector dissipation. However, if the ambient temperature were slightly less than the maximum junction temperature we could allow some contribution to the temperature rise due to collector dissipation.

In addition to the special thermal characteristics required by the high power operation, there are two important electrical design considerations associated with power transistors. *These two effects are the decline of current amplification factor with emitter current and the non-linear input impedance.*

The decline in current amplification factor with emitter current is shown in Fig. 2, for both a doped and non-doped emitter junction. Since, for given terminations, the power gain of the transistor is proportional to the square of the current amplification, this decline in current amplification would be seen as a "rounding off" of the output signal waveform due to the distortion introduced by the non-linear amplification. This decline in amplification is due to the change in emitter efficiency that occurs at high values of emitter currents. This decline can be somewhat overcome by the use of doping agents such as aluminum and gallium. The improvement is shown by the doped emitter curve of Fig. 2. Notice that the high current amplification factor is higher for the doped case and, also, that the percentage decline at high currents is much less for this case. Most present day power transistors use emitter doping to improve the high current characteristics.

The non-linear input characteristics of power transistors indicate that a sinusoidal current variation must be applied to obtain a sine wave output. This requires a high impedance or constant current source. If a low impedance, or constant voltage source is used, the current in the input circuit would not be sinusoidal even though the voltage applied to the input were a sine wave. The amount of non-linearity in the input circuit varies with the transistor configuration. Figs. 3, 4, and 5 show the relationship between generator voltage and output current

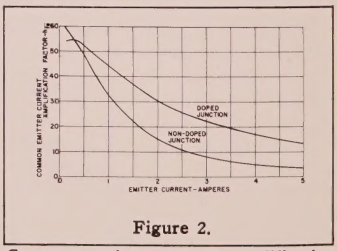


Figure 2.

Common emitter current amplification factor vs. emitter current.

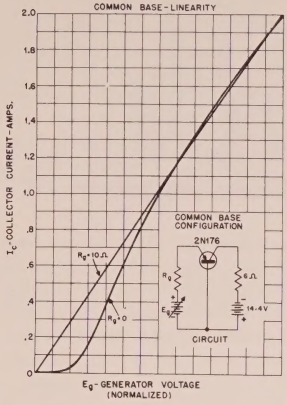


Figure 3.

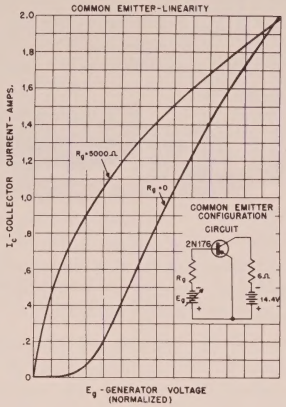


Figure 4.

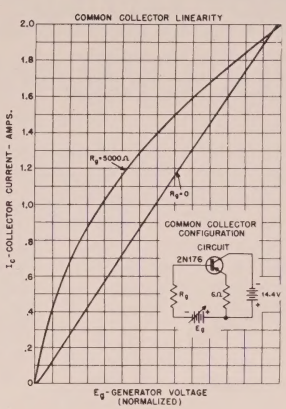


Figure 5.

for the three transistor configurations for a typical value of load. These transfer characteristics take into account not only the non-linear input impedance but the non-linear current amplification factor as well. The values chosen in each case are an approximation to a constant current (R_g high with respect to input impedance) and constant voltage generator (R_g equal to zero). Practical source impedances would lie somewhere between these two extremes. *The departure of this transfer characteristic from a straight line is a measure of the distortion present with that particular configuration.*

Although the gain of the stage will be determined by the particular transistor configuration used, the maximum power output is determined by the value of resistive load and supply voltages. In most cases the value of the load will be substantially less than the matched output resistance of the transistor so that there will be significant mismatch. Thus the power gain for a power stage will be less than that of a low level stage using the same unit. Fig. 6 shows the relationship between load, power output and gain for the three configurations. It will be noted that the common emitter has the greatest value of power gain at all loads.

The usual design problem for an output stage is to find the load that will permit the specified amount of power to be delivered with a given supply voltage. This load resistance may be a physical resistor or, more likely, will be the reflected resistance through an impedance matching transformer. The value of the collector load is given approximately by dividing the square of the supply voltage by twice the value of the desired power output. For a single Class A stage this load will be the output load for a single unit. For a push-pull Class B stage, this value will be the load for one unit, not the collector to collector load.

The maximum theoretical efficiency of 50% for a Class A stage indicates that the maximum allowable power output from a Class A stage approaches one-half the dissipation rating of the transistor used in the output stage. Class B operation will permit the maximum sine wave power to be obtained for a given drain from the power supply. With Class B operation, a power output approximately 3.5 times the dissipation rating of the transistors can be achieved.

An important consideration in the design of an audio amplifier for high quality reproduction is the amount of distortion that will be present in the output signal. We have already discussed two of the sources of distortion, namely the non-linear input impedance and the change of current amplification with emitter current. The driver stage immediately preceding the output stage has a considerable influence on the amount of distortion since it determines the magnitude of the source or generator impedance for the output stage. It is essential for the driver stage to have output power capabilities in excess of that required to drive the output stage to full output if the maximum power output is to be obtained with a minimum of distortion.

It might seem that feedback could be used advantageously to reduce some of the distortion that has been described. However, it should be remembered that the short circuit amplification factor for both the common emitter and common collector has a phase angle of approximately 45° in the vicinity of 10 kcps for most of the available transistors. This phase shift, coupled with that of the transformers, is often enough to render the application of large amounts of feedback over more than one stage impractical. » » »

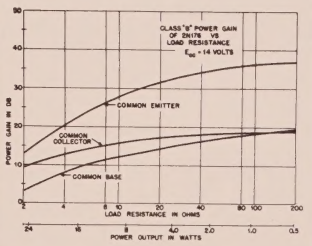


Figure 6.

OPTIMIZING SYSTEM PERFORMANCE

In today's fast moving society, rapid and reliable communications is absolutely essential. At cross reference to this demand is the interference considerations resulting from more and more transmitters being operated in the available spectrum. To minimize these resultant interference problems, optimum performance must be realized from the communications system.

In a general sense, two factors affect system performance:

1. *System Design*
2. *Installation and Maintenance*

SYSTEM DESIGN

The first consideration is the selection of frequency. Three bands are available: 25-50 mc, 150-174 mc and 450-470 mc. The 900 mc range may, at some future date, provide the fourth mobile band. These frequency bands exhibit somewhat different propagation plus other inherent characteristics, influencing the selection.

The low band (25-50 mc) offers an advantage with respect to ground wave propagation. In the high band (150-174 mc), standing waves resulting from multiple propagation paths become noticeable in fringe areas. The 450 mc band also exhibits standing waves, but distance between signal peaks is only a matter of inches.

The electrical noise level is another factor. Here, the 450 mc band claims the advantage, as the level of man-made noise in the lower bands is usually higher than that found in the 450 mc band. Both the high and 450 mc bands show an advantage over the low band in that they are not subject to "skip interference". Skip signals are those coming from distances of several hundred miles due to reflection from or refraction in the ionosphere.

Finally, antenna gain in a reasonable size package must also be considered. Gain is difficult to obtain in the low band, while 4 db and 7 db are reasonable figures for the high band and even 10 db is a practical figure for the 450 mc band.

After the selection of frequency, equipment requirements must be determined to provide the required coverage. This includes base station location, transmitter power requirements, and type and height of base station antenna to be used. To illustrate these requirements, an idealized example of systems design is itemized in Figure #1. The problem requires total coverage within a thirty mile radius using a 60W transmitter. Frequency is 150 mc and the initial antenna height is arbitrarily set at 100 feet. From the computations, it can be seen that total accumulative loss to the worst area is 163 db. In this example, system capability with a 1 microvolt receiver and 60 watt transmitter, is 155 db—a deficit of 8 db. The additional 10 db (2 db for system reserve) is obtained by incorporating a 4 db gain antenna and doubling the antenna height. These calculations, of course, are theoretical and do not necessarily represent the actual case. Actually, the system presented in Figure #1 would be marginal. Customarily, a 10 db margin is added in the low and high bands and a 30 to 35 db margin is added in the 450 mc systems to allow for other factors not included in simple calculations. These factors include such things as foliage and terrain considerations, receiver desensitizing, intermodulation interference, and many others. Receiver desensitization is the result of strong signals close to the desired signal or side band noise from high power transmitters. Intermodulation interference is caused by mixing of undesired signals in a non-linear element in the receiver.

Another form of interference is modulation splatter from an adjacent channel. This interference is of two forms, that which produces nuisance interference by causing the conventional carrier squelch to open, and that which produces loss of communication during modulation of an adjacent channel transmitter. Little can be done to correct interference from an adjacent channel, but you *can* prevent *your* transmitter from causing such interference by incorporating a low pass filter after the deviation limiter or IDC circuit. The improvement in modulation splatter with the use of such a filter is shown in Figure #2.

The interference problems, though many, do not paint the picture all black. A recent Motorola development, "PRIVATE-LINE" Radio, serves to reduce or eliminate many of these forms of interference. "PRIVATE-LINE" Radio employs a tone coded squelch system to open *only* for messages originating in the same radio system. The transmitter is continuously modulated by a low frequency tone. This tone, generated by a highly reliable mechanical reed device, operates a similar mechanical element in the receiver, which in turn opens the receiver squelch. The receiver will not open for any other signal, regardless of carrier strength.

INSTALLATION AND MAINTENANCE

The second factor affecting two-way systems performance is installation and maintenance. Properly made power connections as well as proper grounding are of the utmost importance. Improper grounding can cause ignition noise and vibrator hash in an otherwise clean system. Also, in making the mobile installation, it is important that the voltage regulator on the vehicle be checked, particularly in the case of 12 volt cars. Instructions for doing this can

Base Antenna Height	100 feet	Assume 1 microvolt receiver sensitivity	
Effective Mobile Antenna Height	6 feet	1 microvolt across 50 ohms is: $\frac{(1 \times 10^{-6})^2}{50} = 2 \times 10^{-14}$ watt	
Path Loss Over Plane Earth	147 db	This is 137 db below 1 watt	137 db
Diffraction Loss (Earth Curvature)	9 db	60 W transmitter is 18 db above 1 watt	18 db
Transmission Loss (Base and Mobile)	2 db	System Capability (1 mv rcvr and 60 W xmtr)	155 db
Total Loss Over Smooth Earth	158 db	4 db Antenna will increase capability by:	4 db
Shadow Loss (Geographic Obstruction)	5 db	Doubling Antenna Height gives additional:	6 db
Total Loss to Worst Area	163 db	Revised System Capability	165 db
		System Reserve other Than Difference Between Actual Receiver Sensitivity and 1 microvolt	2 db

Figure #1—A typical example of calculating a system coverage problem.

be obtained from the regulator manufacturer.

The part of the installation involving the most work is noise suppression. Briefly the steps which are the most efficient are as follows:

1. *Use of a resistive ignition harness.*
2. *Use of a shield capacitor from armature to ground, or the installation of a generator filter.*
3. *Hood wipers to prevent ignition noise from spraying directly into the antenna.*
4. *Proper bonding between vehicle frame and body.*
5. *Bonding between sections of tail pipe and muffler.*
6. *Use of capacitors on gasoline and oil gauges.*
7. *0.01MF capacitors on generator field and regulator terminals.*

All the foregoing may have been properly observed and yet a system may still fail to perform properly if not maintained. The most important single item in transmitter maintenance is correct frequency adjustment. It is essential that all transmitters and receivers in a system be set to the same value, i.e. "netted." Otherwise, much of the side band energy containing the transmitted intelligence may be lost because it falls outside the receiver's pass band. Then, too, impulse noise has more degrading effect on a signal which does not fall at the center of the receiver pass band.

Next in importance is proper setting of transmitter deviation. This is the one single item which is most frequently misadjusted. Illustrating the importance of proper deviation adjustment is the fact that a signal, deviated 15 kc, will produce 4 times as much audio power in the receiver as a deviation setting of only 7½ kc. The most foolproof means of adjusting deviation is to use a calibrated receiver with an oscilloscope connected to the discriminator output. The oscilloscope will then show the correct deviation regardless of audio wave form. Most deviation meters operate on RMS or average value but are adjusted to indicate peak in terms of a sinusoidal wave. These meters are accurate *only* when the wave form being measured is sinusoidal.

Of somewhat lesser importance to system performance is transmitter power output. However, power output must drop several db before it will show up as a reduction in system coverage.

Probably the most important item to be considered in receiver maintenance is the sensitivity. If a receiver has sufficient gain to provide full limiting in the first limiter stage and still exhibits poor sensitivity, the difficulty will be generally found in the RF or first mixer stages since these stages normally determine the sensitivity of the receiver.

Next, proper operation of the squelch should be checked. A properly operating squelch should open on a signal which produces from 3 to 4 db of quieting in the receiver when the squelch control is set at threshold. Finally, reserve gain should be checked. The simplest method is to check the grid current of the first limiter stage with no signal applied to the receiver. A below normal reading indicates gain is down in one of the stages preceding the limiter.

When tubes are changed in either a receiver or transmitter, the tuned circuits preceding and following the tubes should be checked for alignment. As a final check on alignment, the discriminator noise idle should be at zero. This is an indication that the pass band of the receiver is symmetrical. If the discriminator idle is off and all of the tuned circuits have been correctly peaked, the situation can be corrected with little or no loss of gain by adjusting one of the relatively broad IF coils immediately preceding the limiters.

In summary, if you own or operate a two-way radio system, you deserve the best performance possible from that system. If your system is properly designed, if the proper equipment has been selected and if the equipment is properly maintained, this optimum performance is insured. » » »

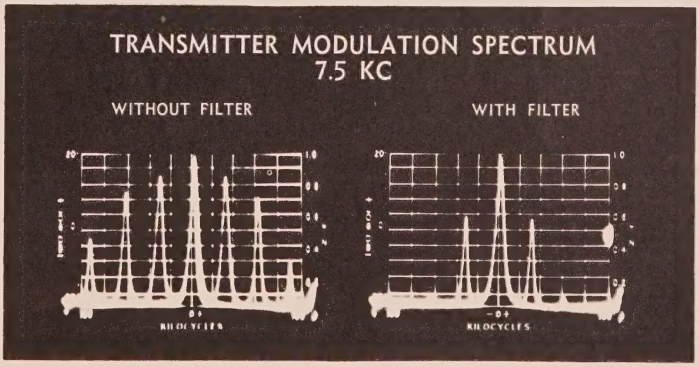
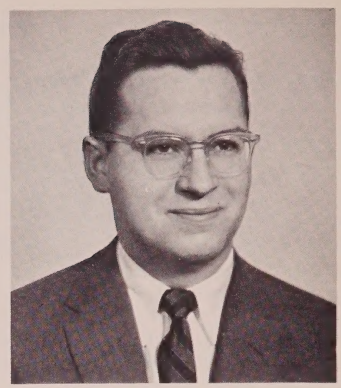


Figure #2—Actual oscilloscope photos showing improvement in modulation splatter thru the incorporation of a low pass audio filter.

JOSEPH A. GENTILE

H. S. BERCK



RICHARD G. JONES

TRANSMISSIONS . . .
On Motorola Personnel

Joseph A. Gentile has been appointed Manager of Marketing Administration for Motorola's Semiconductor Division at Phoenix.

Dr. W. R. Sittner, Manager of Marketing of the Division, said the move is another step by Motorola in expanding to meet the fast growing demand for its products in national and foreign markets. Gentile was formerly with the MIT Lincoln Laboratory in its electronic component parts and materials program. » » »

H. Steven Berck has been named Manager of Distributor and Export Sales for Motorola's Semiconductor Division at Phoenix, Arizona.

Dr. W. R. Sittner, Manager of Marketing, in announcing the appointment, pointed out that the move reflects an integrated effort by the division to extend the domestic and export distribution of semiconductor products. Berck was formerly with the marketing section of the General Electric semiconductor department. » »

Richard G. Jones has been named District Manager, Western Area, for Motorola's Microwave and Industrial Control Products Department.

Jones has been with Motorola's Communications and Industrial Electronics Division since February, 1956, as an Industrial Communications Sales Representative in the Midwest area. In his new duties, he will direct microwave sales activity in the 10-state Western area from the Burlingame, California, office. » » »

Service School Held for Railroad Radio Technicians

Motorola recently concluded what Floyd McCall, Vice President of railroad sales, termed an important "first" among manufacturers of 2-way radio equipment for railroad use.

This innovation, McCall said, was the holding of a week-long service school designed strictly for railroad 2-way radio technicians at Motorola's service training center in Chicago.

"As far as we can determine," McCall pointed out, "this is the first time that a radio school of this length and intensity has been devoted entirely to railroad equipment.

McCall emphasized that extensive use of radio equipment and new developments in the railroad industry have intensified the need for skilled technicians.

Motorola's purpose in holding this school, he pointed out, was to help fill this need. » » »

Floyd McCall (left) points out features of Motorola test equipment to Allen Frank, W. D. Trotter and Russell Siler at the Motorola Service School held in Chicago which was devoted entirely to Railroad two-way radio equipment.

SALES service

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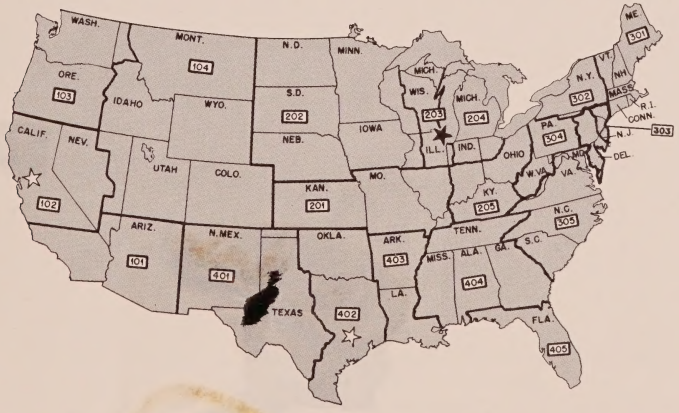

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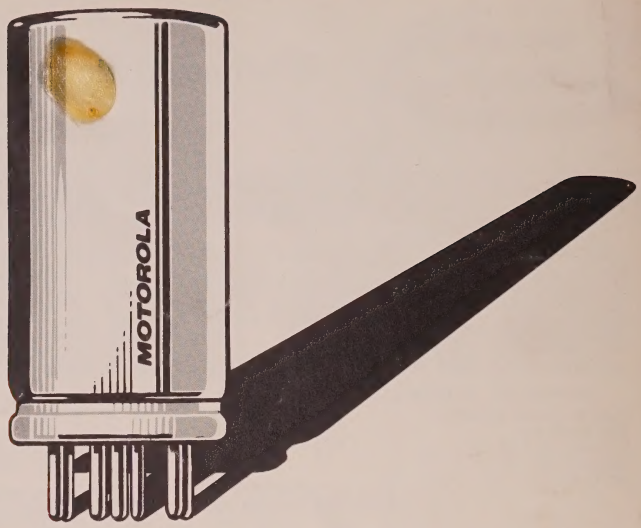
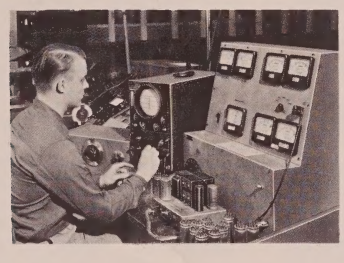


TWO STEPS TO BETTER VIBRATORS

vibrator selection
incoming quality control



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